

We claim:

1. A fuel cell system comprising:
  - (a) a fuel cell having an oxidant inlet; and
  - (b) a filter assembly comprising:
    - (i) an inlet configured to receive a dirty oxidant stream having gas phase contaminants;
    - (ii) a filter element adapted to remove the gas phase contaminants from the dirty oxidant stream received through the inlet, to provide a cleaned oxidant stream; and
    - (iii) an outlet configured for connection to the fuel cell oxidant inlet, through which the cleaned oxidant stream passes to the fuel cell.
2. The fuel cell system according to claim 1, wherein the filter element comprises adsorbent material selected from the group consisting of activated carbon, impregnated carbon, activated carbon fibers, ion-exchange resin, ion-exchange fibers, alumina, activated alumina, molecular sieves, and silica.
3. The fuel cell system according to claim 2, wherein the filter element comprises at least one solid mass of adsorbent material.
4. The fuel cell system according to claim 3, wherein the filter element comprises extruded activated carbon.
5. The fuel cell system according to claim 4, wherein the extruded activated carbon has a curved shape.
6. The fuel cell system according to claim 2, wherein the filter element comprises granulated adsorbent material.

7. The fuel cell system according to claim 2, wherein the filter element comprises a shaped adsorbent material.
8. The fuel cell system according to claim 1, wherein the filter assembly is configured to remove gas phase chemical contaminants and particulate chemical contaminants.
9. The fuel cell system according to claim 1, wherein the filter element is configured to remove any of methane, butane, propane, other hydrocarbons, ammonia, oxides of nitrogen, oxides of sulfur, carbon monoxide, and hydrogen sulfide.
10. The fuel cell system according to claim 1, wherein the filter assembly system comprises a hydrophobic layer.
11. The fuel cell system according to claim 1, wherein the filter assembly comprises an absorbent material.
12. A filter assembly for use with a fuel cell, the filter assembly comprising:
  - (a) at least one inlet configured to receive a dirty gas stream;
  - (b) an outlet adapted to be connected in communication with an oxidant inlet of a fuel cell;
  - (c) a particulate filter;
  - (d) a chemical filter comprising carbon adsorbent material;
  - (e) the particulate and chemical filters being configured, in combination, to remove particulate and gas phase contaminants from the dirty gas stream and to provide a cleaned gas stream, suitable for use by a fuel cell, to the outlet.
13. The filter assembly according to claim 12, wherein the carbon absorbent material comprises impregnated carbon material.

14. The filter assembly according to claim 12, wherein the carbon absorbent material comprises extruded activated carbon.

15. The filter assembly according to claim 13, wherein the impregnated carbon material includes an acidic surface constructed and arranged to remove a basic contaminant, the basic contaminant being selected from the group consisting of ammonia, amines, amides, sodium hydroxides, lithium hydroxides, potassium hydroxides, volatile organic bases and nonvolatile organic bases.

16. The filter assembly according to claim 13, wherein the impregnated carbon material includes a basic surface constructed and arranged to remove an acidic contaminant, the acidic contaminant being selected from the group consisting of sulfur oxides, nitrogen oxides, hydrogen sulfide, hydrogen chloride, and volatile organic acids and nonvolatile organic acids.

17. A fuel cell system comprising:

- (a) a fuel cell having an oxidant inlet; and
- (b) a filter assembly comprising:
  - (i) an inlet configured to receive a dirty oxidant stream having gas phase contaminants;
  - (ii) a filter element adapted to condition the dirty oxidant stream received through the inlet, to provide a cleaned oxidant stream with gas phase contaminants below a predetermined threshold limit; and
  - (iii) an outlet configured for connection to the fuel cell oxidant inlet, through which the cleaned oxidant stream passes to the fuel cell.

18. The fuel cell system according to claim 17, wherein the filter element releaseably captures the gas phase contaminants.

19. The fuel cell system according to claim 17, wherein the filter element captures and permanently retains the gas phase contaminants.
20. A method of controlling contaminants within a gas stream to a gas inlet of a fuel cell, the method comprising:
- (a) providing a filter assembly comprising a particulate filter and a chemical filter comprising carbon absorbent material, each of the particulate filter and the chemical filter having an inlet and an outlet;
  - (b) passing a dirty gas stream into the inlet of each of the particulate filter and the chemical filter to remove contaminants from the dirty gas stream to provide a cleaned gas stream; and
  - (c) providing the cleaned gas stream to the gas inlet of the fuel cell.
21. The method according to claim 20, wherein the carbon absorbent material comprises impregnated carbon absorbent material.
22. The method according to claim 21, further comprising:
- (a) providing the impregnated carbon material with an acidic surface constructed and arranged to remove a basic contaminant, the basic contaminant being selected from the group consisting of ammonia, amines, amides, sodium hydroxides, lithium hydroxides, potassium hydroxides, volatile organic bases and nonvolatile organic bases.
23. The method according to claim 21, further comprising:
- (a) providing the impregnated carbon material with a basic surface constructed and arranged to remove an acidic contaminant, the acidic contaminant being selected from the group consisting of sulfur oxides, nitrogen oxides, hydrogen sulfide, hydrogen chloride, and volatile organic acids and nonvolatile organic acids.

24. The method according to claim 20, wherein the carbon absorbent material comprises extruded carbon absorbent material.